NEW INSTRUMENT DEVELOPED FOR MEASURING DISSOLVED OXYGEN IN AVIATION FUEL

Payoff

The new laser-based diagnostic technique provides continuous, near-real-time quantitation (precision measurement) of dissolved oxygen in aviation fuel. Increased understanding of dissolved-oxygen chemistry will accelerate the development of advanced fuels and ultimately reduce aircraft downtime due to fuel-system maintenance. The apparatus not only has significant advantages and unique capabilities, but is also more compact and costs $10,000 less than equipment in current use.

Accomplishment

Dr. James R. Gord of the Propulsion Directorate, working with Dr. Steven W. Buckner, an Air Force Office of Scientific Research program participant, developed a new laser-based technique for measuring dissolved oxygen in aviation fuel. The technique precisely measures dissolved oxygen in the natural position without disturbing fuel-flow conditions (nonintrusive) or consuming the sample (nondestructive).

Background

Many aircraft performance improvements are accompanied by substantial heat loads that lead to

increased thermal stress on the fuel--the primary coolant for on-board heat sources. The result is increasingly complex thermal management, which affects aircraft design and maintenance requirements. Through studies of aviation fuels and fuel additives, Directorate researchers have identified the critical role of dissolved-oxygen chemistry in fuel thermal stability. A reliable method for measuring dissolved oxygen is essential to continued fuel improvement. The dissolved-oxygen-quantitation technique developed by Dr. Gord offers significant advantages over the gas-chromatograph (GC) approach currently in use. The GC provides two to three oxygen measurements per 15-minute period and consumes the sample. The new laser-based technique provides an oxygen-concentration measurement every 10 seconds or less without consuming the sample. The generation of oxygen-consumption curves requires days with the GC but only minutes with the laser. The technique is ideal for flowing-fuel rigs and has been validated on the Directorate's near-isothermal flowing test rig. It also has tremendous potential for dual-use applications that involve oxygen quantitation in harsh environments.